

NOTES ON DISTRIBUTION AND BIONOMICS OF THE DUNG FLY, *SCATHOPHAGA TROPICALIS* (DIPTERA: SCATHOPHAGIDAE), IN PERU¹

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ABSTRACT: *Scathophaga tropicalis* was collected from 3460 to 5008 m on the eastern slope of the Andes during an intensive survey for coprophagous and saprophagous flies along a transect in central Peru. Data and observations are presented on bait attraction, larval medium, synanthropy, and predatory nature of *S. tropicalis*. Scanning electron micrographs of the adult fly proboscis show adaptations for a predaceous feeding habit.

Scathophagidae are typically northern Nearctic, cold-adapted flies. Many species of the most common and most conspicuous genus, *Scathophaga* Meigen, are visually distinguished by a covering of long, yellow-orange, dense hairs (Cole and Schlinger, 1969). The family is well represented in the Nearctic by 32 genera and 145 species (Stone et al., 1965), but is scant in the Neotropics with 3 genera and 7 species (Albuquerque, 1984; Dr. Vockeroth, pers. comm.). Habits of both larvae and adults vary greatly; some species are dung feeders throughout their life cycle, a few larvae are scavengers along seacoasts and leafminers in plants, others develop in aquatic vegetation, and perhaps all are predatory as adults (Stone et al., 1965; Cole and Schlinger, 1969). Predatory species may be important natural controls of medically important Diptera such as houseflies (Hewitt, 1914), mosquitoes (Service, 1973; Khaliulin and Zainullina, 1978), and blowflies (Cotterell, 1920), while other dung flies may be medically important themselves as vectors of pathogens among livestock and man (Markus, 1980; L'vchiev and Zhekov, 1980).

Although much is known of the reproductive behavior (see Parker, 1974) and ecology (Coffey, 1966) of Holarctic *Scathophaga* (= *Scopeuma*) *stercoraria* (L.), little is known of the bionomics of other species (Stone et al., 1965), especially those occurring in South America. I now report on the distribution and bionomics of *Scathophaga tropicalis* Malloch in Peru, a species also known from Argentina, Bolivia, and Chile (Cuny, 1983). Mouthparts of this fly were examined to relate its structure to its predatory nature and for comparisons with the mouthparts of *S. stercoraria*.

MATERIALS AND METHODS

Scathophagidae were collected concurrently with Calliphoridae during an intensive investigation of the distribution and medical ecology of the

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blow flies of Peru. In general, the methods outlined below follow those of Baumgartner and Greenberg (1985). Collections were made along an altitudinal transect (12° S. latitude) from the coastal desert at Lima, across the Andes, and down into the rain forest on the eastern slope in December 1977, June and July 1980, and December 1981, with usually less than 500 m and no greater than 1000 m between consecutive sites. For synanthropic index determinations flies were netted at eu-, hemi-, and asynanthropic sites simultaneously (0900-1600 hrs) at 4000 m on fish, beef liver, aged fruit, and animal (dog, pig, cow, human) feces. More detailed descriptions of the study area, collection sites, and methods are given by Baumgartner (1984), and Baumgartner and Greenberg (1985). Distribution records of Scathophagidae in Peru are supplemented by a loan from the Universidad Nacional Agraria, Lima (U.N.A.).

A large sample of the Scathophagidae collected was sent to Dr. J.R. Vockeroth, Biosystematics Research Institute, Ottawa, Canada for identification. All were determined to be a single species, *Scathophaga tropicalis*. Voucher specimens have been deposited at the National Museum of Natural History, Museum Nacional (Rio de Janeiro, Brasil), and Biosystematics Research Institute. Additional material is housed at the University of Illinois at Chicago under the care of Dr. B. Greenberg, Department of Biological Sciences.

Mouth parts were prepared for scanning electron microscopy (SEM) by mounting an excised proboscis with everted labellar lobes from a male and female dry, pinned specimens on SEM stubs with double-sided tape. The material was vacuum sputter-coated with gold/palladium (ca. 20 nm) and viewed in an International Scientific Instruments (ISI-DS-130) scanning electron microscope.

RESULTS AND DISCUSSION

Records of *Scathophaga tropicalis* in Peru

Lima Dist.: Matucana, 2440 m, 13-15C, eusynanthropic site (eu), fish (f), 15: XII: 1977, 3 ♂, 1 ♀.

Junín Dist.: Anticona, 5008 m, < 7 C, asynanthropic site (as), f, 23: XII: 1981, 1 ♀; Morococha, 4500 m, < 7 C, eu, f, 15: XII: 1977, 6 ♂, 2 ♀; Morococha, refuse, 4: XII: 1979, 9 ♂, 1 ♀; Morococha, hemisynanthropic (hemi), refuse, XII: 1977, 7 ♂, 5 ♀; Morococha, eu, f, 23: XII: 1981, 2 ♀; 5.5 km NW Queropuquio, 4177 m, hemi, 18: VI: 1980, human feces, 1 ♀, pig feces, 2 ♀, dog feces, 1 ♀; 25 km W. Tarma, 3994 m, 7-9 C, hemi, f, 18: VI: 1980, 4 ♀; 3994 m, cow feces, 4 ♂; 3994 m, f, 11: XII: 1981, 7 ♂, 7 ♀; 3994 m, pig pen, 7 ♂; 3994 m, cow pasture, 12 ♂, 1 ♀; La Oroya, 3660 m, 9-11 C, eu, refuse, 5: VII: 1980, 1 ♂; La Oroya, f, 26: XII: 1981, 1 ♂; Jauja, 3550 m, 9-11 C, hemi, f, 12: XII: 1979, 1 ♀; Jauja, dog carrion, 7-10: XII: 1979, 1 ♂, 5 ♀; Huancavelica, 3700 m, II: 1950, 1 ♂, F. Blancas leg., U.N.A. loan; Acolta (cerca Jauja), 3460 m, II: 1952, 1 ♀, Blancas leg., U.N.A. loan; Acolta, 3: I: 1954, 1 ♂, Blancas leg., U.N.A. loan.

Fifty-eight male and 34 female *Scathophaga tropicalis* were collected, only in the Peruvian highlands, within an altitudinal range of 3460 to 5008 m on the eastern slope of the Andes and at 2440 m on the western slope. In Jauja (3550 m), *S. tropicalis* was active from 0700 to 1300 hrs. (sun temp. 16-25 C, shade 15-23 C) on dog carrion and on the altiplano at 4000 m specimens were captured on baits from 1000 to 1330 hrs. (mean sun temp. 15 C), with flies on the wing at temperatures as low as 12 C (weather overcast, no sunshine). This high altitudinal distribution (alpine to nival biotic zones, see Baumgartner and Greenberg, 1985) and activity at low temperatures agrees with collection records of *S. tropicalis* from other Peruvian localities (Cuny, 1983) and is similar to that of other *Scathophaga* species elsewhere. *Scathophaga stercoraria* has been collected at 4900 m on the Himalayas (Gregor and Daniel, 1976), and a number of species occur in the Eurasian tundra and high mountain pastures of the Carpathian Mountains (Greenberg, 1971).

Scathophaga stercoraria is well known as a symbovine and coprophagous fly, reported to be attracted to and to breed in the excrement of cattle, swine (Coffey, 1966), sheep, horses, and humans (Greenberg, 1971). In Peru, *S. tropicalis* appears to be coprophagous and saprophagous also for it was netted on cow, pig, dog, and human feces, and on refuse, dog carrion, and fish baits.

Indirect evidence suggests that *S. tropicalis*' larval habitat is manure, as that of many other species of the genus. On a family farm at ca. 4000 m I observed and collected 15 male and 1 female specimens in and near cattle and swine holding pens containing a mixture of feces, mud, and straw. In England, *S. stercoraria* also aggregates near cow pats where very high densities of males are prevalent, competing for females (Parker, 1970). Upon questioning, the farmers reported that *S. tropicalis* lays its eggs on, and the larvae live in, swine and cattle excrement, where they may be predaceous.

Greenberg (1971) describes *S. stercoraria* as being facultatively eusynanthropic under rustic conditions, but otherwise hemisynanthropic. *Scathophaga tropicalis* appears to be no different. Although the numbers are low and their relevancy questionable since adults are more symbovine, I calculated a synanthropic index of + 50 ($n=22$, at 4000 m) which is indicative of a hemisynanthropic habit. In fact, the majority of specimens (69%, $n=88$) were captured at hemisynanthropic sites, with only 1 netted at an asynanthropic area.

Both sexes of adult *S. stercoraria* are well known indiscriminate predators of other adult Diptera (ref. cit.), and their sponging mouthparts are modified accordingly (Cotterell, 1920; Hobby, 1934; Bletchly, 1953). Their fleshy labella, terminal on a flexible, retractile proboscis possess few pseudotracheae, and well developed prestomal teeth for rasping punctures

in the exoskeleton of its prey. Habits and proboscis morphology of adult *S. tropicalis* generally agree with that of *S. stercoraria*. During bait collections, *S. tropicalis* appeared to be drawn upwind to carrion in search of prey, rather than to feed directly on the carrion. Under the low temperatures of high altitudes these dung flies remained low to the ground and were airborne for only momentary periods, finally alighting close to the carrion as if patrolling for insect prey. On a few occasions adults were observed capturing smaller Diptera, in one instance an adult captured and fed upon the flow fly *Sarconesia magellanica* (LeGuillou) (Fig. 1B). Labellar morphology is also consistent with a predaceous habit (Fig. 2). The labella are reduced when everted, exposing 2 rows of greatly enlarged prestomal teeth, each of which consisted of 8 bicuspid teeth fused at their bases into a plate articulating with the discal sclerite (Figs. 2B and 2C). Figure 2D also shows detail of the enlarged lateral pseudotracheae, relatively few in number for flies (8 for labellar lobe), which are ribbed and tubular in appearance as they lead into the food canal. No sexual differences were observed among the mouthparts of *S. tropicalis*. By contrast, *S. stercoraria* has been reported to have 9 pseudotracheae and usually 7 fused bicuspid teeth (Bletchly, 1953).

The aforementioned results indicate that *S. tropicalis* occupies a niche in Peru akin to that of Holarctic *S. stercoraria*. This investigation now forms a basis for future studies on *S. tropicalis*' importance as predators of alpine, disease-vectoring flies.

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Figure 1. A) Typical hemisynanthropic habitat (4000 m) of *Scathophaga tropicalis* and; (B) a male *S. tropicalis* preying upon the blow fly *Sarconesia magellanica* in a field near Juaja.

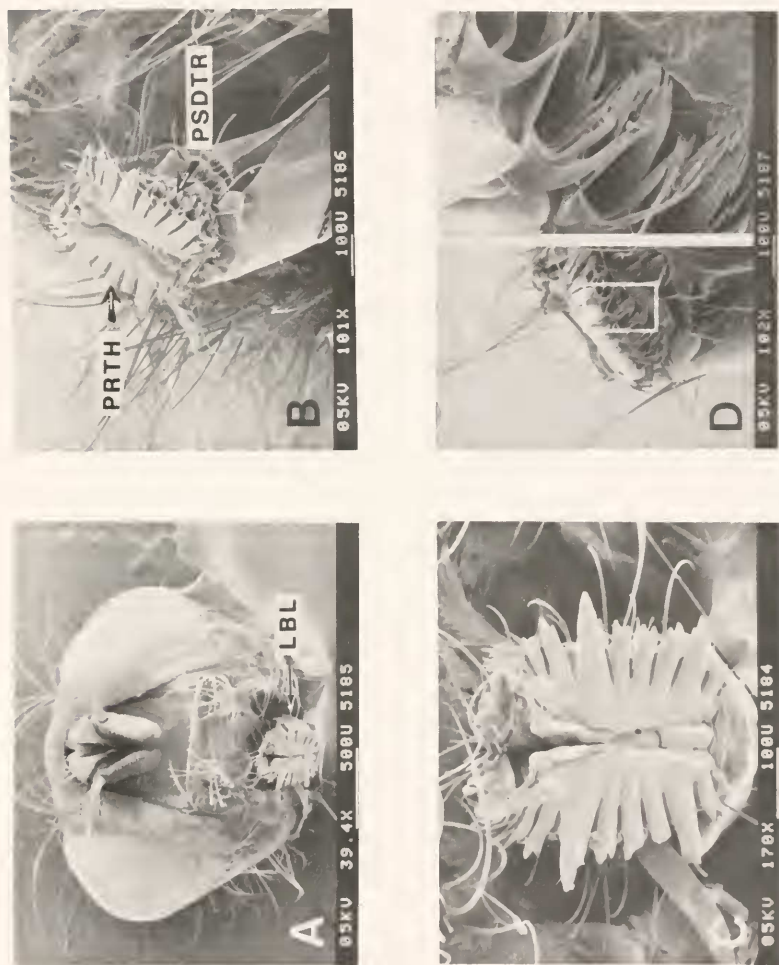


Figure 2. S.E.M. micrographs of female *Scathophaga tropicalis* mouthparts: (A) head showing everted labellum (LBL) with enlarged prestomal teeth; (B) anterior-ventral view of proboscis showing everted prestomal teeth (PRTH) and attached pseudotracheae (PSDTR); (C) terminal view of labellum with everted prestomal teeth and; (D) lateral view and enlargement (right half, 510X) of pseudotracheae attached to prestomal teeth. Numbers at bottom of each micrograph signify (left to right) voltage, magnification, scale bar (in microns), and UIC photo reference number.

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